

## PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2003-132596

(43)Date of publication of application : 09.05.2003

(51)Int.Cl.

G11B 7/26

G11B 7/24

(21)Application number : 2001-324013

(71)Applicant : TDK CORP

(22)Date of filing : 22.10.2001

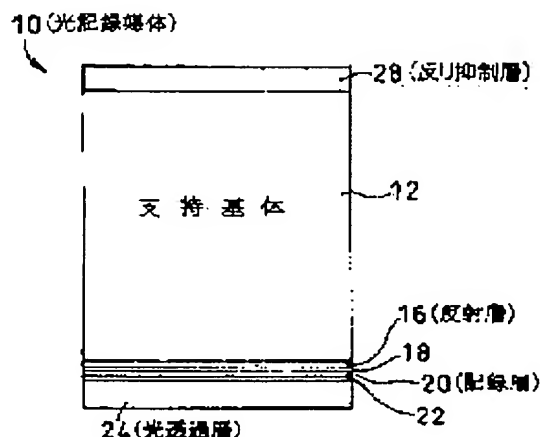
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## (54) DESIGNING METHOD OF OPTICAL DATA-STORAGE MEDIUM

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To provide a designing method for restraining the occurrence of curvature caused by the expansion and contraction of a light-permeable layer 24 together with a substrate due to drastic change in temperature in an optical data-storage medium having the comparatively thick light-permeable layer.

**SOLUTION:** The optical data-storage medium 10 is provided with a reflection film 16, recording layer 20, light-permeable layer 24 comprising acrylic resins of about 100  $\mu\text{m}$  in thickness all of which are on the surface of one side of the substrate 12, and a curvature-restraining layer 28 on the surface of the opposite side of the substrate 12. The change in curvature angle is measured when the data-storage medium is given drastic change of temperature, and, based on the result of the measurement, the thickness of the curvature-restraining layer 28 is adjusted, and the change in curvature angle is set to be within 0.4 by the countervailing between the expansion and contraction of light-permeable layer 24 and the expansion and contraction of the curvature-restraining layer 28.



## LEGAL STATUS

[Date of request for examination]

18.10.2004

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

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CLAIMS

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[Claim(s)]

[Claim 1] The design approach of the optical recording medium characterized by wearing the information recording surface formed in the support base, and designing an optical recording medium so that the variation may serve as the target value when it takes out by the room temperature environment and the amount of curvatures of said optical recording medium is measured after saving the optical recording medium which has at least the light transmission layer whose thickness is 20-150 micrometers 60 minutes or more in an ambient atmosphere 60 degrees C or more.

[Claim 2] For said indoor environment, 23\*\*2 degrees C and relative humidity are the design approach of an optical recording medium that it is characterized by temperature being 50\*\*10%RH in claim 1.

[Claim 3] The design approach of the optical recording medium characterized by setting up the value of the purpose of said variation with less than 0.4 degrees in claim 1 or 2.

[Claim 4] The design approach of an optical recording medium that the maximum variation of said amount of curvatures to said rapid temperature change is characterized by being the following by /0.2 degrees in claims 1 and 2 or 3.

[Claim 5] claim 1 -- moreover -- or the design approach of the optical recording medium which takes out measurement of the variation of said amount of curvatures by the room temperature environment, and is characterized by being spacing for 1 minute till for 10 minutes after measurement initiation of change of the amount of curvatures in either of 4.

[Claim 6] The design approach of the optical recording medium characterized by the thing of said support base set up at least so that a curvature control layer may be arranged to said information recording surface and field of the opposite side and the amount of curvatures of an optical recording medium may become in a predetermined value in them in claim 1 thru/or either of 5.

[Claim 7] the design approach of the optical recording medium which a resin layer and a printing layer come out on the other hand at least, and said curvature control layer has in claim 6, and is characterized by said printing layer being a resin layer containing either a pigment or a color.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the design approach of an optical recording medium.

[0002]

[Description of the Prior Art] Optical recording media (disk), such as the conventional CD (Compact Disc) and DVD (Digital Versatile Disc), are manufactured so that it may become in the condition (initial state) of having been manufactured, in the specification the property (an electrical property and mechanical characteristic) was variously decided to be, and it is further defined as a property satisfying a value of standard variously also after accelerated tests, such as a high-humidity/temperature preservation test, over a long period of time for compensation of dependability. It is required as one of the indexes of dependability over a long period of time [ this ] that the amount of curvatures of the entire disk in accelerated test order should be less than constant value. Such conventional CD, conventional DVD, etc. consist of a light transmission nature substrate (light transmission layer) which mainly consists of a polycarbonate. The main cause of curvature Said polycarbonate substrate, A recording layer, a reflecting layer, a protective layer, and at least when are constituted possible [ record ], and it is constituted further only for playbacks, at least A reflecting layer and a protective layer, Furthermore, when it had a printing layer, the accelerated test (high-humidity/temperature and accelerated test only according to an elevated temperature or a highly humid chisel) was carried out as a trial which checks dependability over a long period of time [ since / said ] by gap of the balance of the stress by telescopic motion including it, and sufficient management was carried out.

[0003] On the other hand, a record playback layer is prepared in record and/or a refreshable condition on a support base, a light transmission layer is formed on it, and the optical disk (optical recording medium) it was made to irradiate the laser beam which performs record/playback from this light transmission layer side is proposed so that it may be indicated by JP,1996-235638,A.

[0004] Here, the acrylic resin which applied the hardening technique variously, such as a case where a polycarbonate resin film is prepared through a glue line as said light transmission layer, ultraviolet curing, and heat curing, was prepared, and when said stress balance collapsed in these cases, various conditions were adjusted in consideration of curvature occurring. Furthermore, I thought that it was for expanding as main causes by which stress balance collapses when resin, such as the stress relaxation and the polycarbonate of each class, and an acrylic, absorbs moisture.

[0005]

[Problem(s) to be Solved by the Invention] However, this invention persons discovered that change of the big amount of curvatures occurred immediately after said elevated-temperature accelerated test, when the quality of the material of said light transmission layer was [ the thickness of a light transmission layer ] 20 micrometers or more further unlike the quality of the material of said support base.

[0006] With change of the big amount of curvatures of an immediately after [ this elevated-temperature accelerated test ] When it takes out after elevated-temperature preservation and cold storage (for example, 80-degree-C 12 hours) (-20-degree-C 12 hours) and the amount of curvatures is measured in a room temperature environment, it is what changes steeply for a short time. Generating of the steep curvature in such a short time For example, the time of carrying an optical recording medium into the room whose air conditioning was suddenly effective against the hot day of summer from outside, The trouble that it is high, and possibility of generating when an optical recording medium is suddenly carried into the warm room in cold winter can equip with it, or cannot use an optical recording medium for a drive for a while in this case arises.

[0007] This invention is made in view of the above-mentioned trouble, and stress balance collapses in an

optical recording medium by the steep temperature change in a short time, and it aims at offering the design approach of designing the optical recording medium it is made for bigger curvature than the value of the amount of curvatures made into the purpose not to generate to it.

[0008]

[Means for Solving the Problem] Said light transmission layer of this invention person is the thickness more than fixed wholeheartedly as a result of research. When coefficient of linear expansion differs from said support base, curvature generating by the stress balance which collapses in moisture absorption by the high-humidity/temperature accelerated test is preceded. By discovering that there is steep curvature generating in a short time by the temperature change, and adopting the design concept which controls steep curvature generating in this short time, even when a temperature change was steep, it found out that an optical recording medium could be made usable.

[0009] That is, the above-mentioned purpose is attained by the following invention.

[0010] (1) The design approach of the optical recording medium characterized by wearing the information recording surface formed in the support base, and designing an optical recording medium so that the variation may serve as the target value when it takes out by the room temperature environment and the amount of curvatures of said optical recording medium is measured after saving the optical recording medium which has at least the light transmission layer whose thickness is 20-150 micrometers 60 minutes or more in an ambient atmosphere 60 degrees C or more.

[0011] (2) For 23\*\*2 degrees C and relative humidity, temperature is [ said indoor environment ] the design approach of the optical recording medium of (1) that it is characterized by being RH 50\*\*10%.

[0012] (3) (1) characterized by setting up the value of the purpose of said variation with less than 0.4 degrees, or the design approach of the optical recording medium of (2).

[0013] (4) The design approach of the optical recording medium of (1), (2), or (3) with which the maximum variation of said amount of curvatures to said rapid temperature change is characterized by being the following by /0.2 degrees.

[0014] (5) Measurement of the variation of said amount of curvatures is the design approach of the optical recording medium of (1) which takes out by the room temperature environment and is characterized by being spacing for 1 minute till for 10 minutes after measurement initiation of change of the amount of curvatures thru/or (4).

[0015] (6) The design approach of the optical recording medium of either (1) characterized by the thing of said support base set up so that a curvature control layer may be arranged to said information recording surface and field of the opposite side and the amount of curvatures of an optical recording medium may become in a predetermined value at least in them thru/or (5).

[0016] (7) the design approach of the optical recording medium of (6) which a resin layer and a printing layer come out on the other hand at least, and said curvature control layer has, and is characterized by said printing layer being a resin layer containing either a pigment or a color.

[0017]

[Embodiment of the Invention] The example of the gestalt of operation of this invention is explained to a detail with reference to a drawing below.

[0018] As shown in drawing 1 , the optical recording medium 10 produced using the design approach concerning the example of the gestalt of this operation is formed at least in order of the reflective film 16, the 2nd dielectric layer 18, a recording layer 20, the 1st dielectric layer 22, the light transmission layer 24, and \*\*\*\* on the support base 12 which consists of a polycarbonate (it sets to drawing 1 and is the bottom). Moreover, the curvature control layer 28 is formed in the opposite side with the light transmission layer 24 grade of the support base 12 in this order at least.

[0019] Said support base 12 is formed by injection molding of polycarbonate resin here, and the thickness is set to about 1.1mm. Besides, said reflective film 16, the 2nd dielectric layer 18, a recording layer 20, and the 1st dielectric layer 22 are formed in this order by the sputtering method, said light transmission layer 24 comes to carry out the spin coat of the acrylic resin, and that thickness is set to about 100 micrometers.

[0020] In addition, EPOSHIKI system resin other than acrylic resin etc. is sufficient, and not only a spin coat method but various methods of application may be adopted, or the formation approach may also be beforehand formed in the shape of a sheet, and, as for the light transmission layer 24, may carry out adhesion etc.

[0021] Therefore, in conventional CD, conventional DVD, etc., said light transmission layer 24 is formed quite thickly as compared with the protection layer thickness (5-10 micrometers) on the resin layer equivalent to the location of the light transmission layer 24 of this optical recording medium 10, i.e., the

reflective film.

[0022] Although said reflective film 16 will not be limited if the reflection factor demanded is filled, but it can apply various metallic materials etc., it is using Ag as the principal component here. Although various ingredients could also apply the 1st and 2 dielectric layers 22 and 18, general ZnS-SiO<sub>2</sub> was used here. Moreover, the recording layer 20 was made into the GeSbTe system which is the recording layer presentation of a common phase change mold.

[0023] Said curvature control layer 28 is suitably used according to the design approach of this invention by forming by the same ingredient (acrylic resin) as the light transmission layer 24, and almost equal thickness, or controlling thickness using other ingredients with which coefficient of linear expansion is different. For example, as compared with the ingredient of a light transmission layer, an ingredient with a big coefficient of linear expansion is formed more thinly than a light transmission layer, or the approach of forming thickly an ingredient with a small coefficient of linear expansion is raised.

[0024] Here, since said light transmission layer 24 is formed in the support base 12 made of polycarbonate resin, and one with acrylic resin as mentioned above, a rapid temperature change is in an ambient atmosphere, and when the change is large, curvature generates it for the reasons of the difference in the coefficient of linear expansion in each unit time amount etc.

[0025] In this optical recording medium 10, the curvature control layer 28 which consists of the same acrylic resin as the light transmission layer 24 can be formed in the front face (it sets to drawing 1 and is a top face) of said light transmission layer 24 and opposite side of said support base 12 by the optimal thickness, and it can control by maintaining the stress balance whose each class has the variation of the amount of curvatures of the optical-recording-medium 10 whole based on telescopic motion by the temperature change of the light transmission layer 24.

[0026] It is made for the variation of the concrete amount of curvatures to serve as the range of less than (detail after-mentioned) 0.4 degrees from an initial state. Furthermore, specifically, the variation of said amount of curvatures is measured by the elevated-temperature retention test. After this trial throws an optical recording medium 10 into an ambient atmosphere 60 degrees C or more 60 minutes or more Room temperature environment (it takes out in 21-25 degrees C of atmospheric temperature, and the ambient atmosphere of 40 - 60% of relative humidity) The amount of curvatures is measured like the after-mentioned, the variation of the amount of curvatures by the heat dissipation for [ of the beginning ] 0 - 20 minutes is measured from measurement initiation, and the thickness of said curvature control layer 28 is adjusted and designed so that said variation may become less than 0.4 degrees from the result.

[0027] Furthermore, it is made for the variation of said amount of curvatures to become a part for /0.2 degrees preferably for steep curvature control.

[0028] Here, as shown in drawing 2 , from a laser light source 30, measurement of the variation of said amount of curvatures irradiates a laser beam to a record medium 10, receives the reflected light at that time with a semi-conductor position transducer (henceforth, PSD), and detects the amount of curvatures of an optical recording medium 10 with the incidence location to this PSD32 of a reflective laser beam.

[0029] Furthermore, when it sets to the detail so that a reflective laser beam may carry out incidence in the center of PSD32, when an optical recording medium 10 is in a direct flat-surface condition without curvature, as drawing 2 is shown by the broken line, and curvature beta arises in an optical recording medium 10, only 2xbeta increases, this serves as gap of the incidence location of the reflective laser beam of PSD32, and the angle of reflection of a reflective laser beam is detected. The amount of gaps to said criteria set up beforehand is made into the amount of curvatures, it supplies beyond fixed time amount to the bottom of an elevated-temperature ambient atmosphere, and let variation of a from be the variation of the amount of curvatures immediately after taking out.

[0030] In the example of the gestalt of this operation, as mentioned above, since the same ingredient as this is adjusting the thickness of the curvature control layer 28 for the curvature control layer 28 to said light transmission layer 24 and opposite side of the support base 12 from the result of formation and an elevated-temperature retention test, telescopic motion of these layers by the temperature change is offset on both sides of the support base 12, and curvature can be managed the optimal by maintaining stress balance.

[0031] In addition, in the example of the gestalt of the above-mentioned implementation, although the curvature control layer 28 is used as the same ingredient as the light transmission layer 24, it may choose the ingredient of the curvature control layer 28 from epoxy system resin, urethane system resin, etc. that this invention is not limited to this and the variation of the amount of curvatures to the temperature change within fixed time amount just makes [ therefore ] it within the limits within the target value.

[0032] Moreover, since the one half of the curvature of this light transmission layer 24 is offset even if it is

the same ingredient as the light transmission layer 24 and the thickness is about 50% of the light transmission layer 24, the adjustable range of the thickness of the curvature control layer 28 should just become above-mentioned [ change of the amount of curvatures which remained ] within the limits. Moreover, it is good conversely also considering the thickness of the curvature control layer 28 as about 1.5 times of the light transmission layer 24.

[0033] Furthermore, in the example of the gestalt of the above-mentioned implementation, although the light transmission layer 24 is formed from acrylic resin, generally this invention is not applied, when using the intense ingredient of telescopic motion by the rapid temperature change in a short time, and is not limited to acrylic resin. Other than acrylic resin, there are epoxy system resin, urethane system resin, etc.

[0034] Furthermore, although said curvature control layer 28 is used as the same ingredient as the light transmission layer 24, since light transmission nature is not required, this curvature control layer 28 may be other opaque or translucent ingredients again. Here, although thickness of said light transmission layer 24 is set to 100 micrometers, this invention is applied to the optical recording medium with which the light transmission layer with a thickness of 20-150 micrometers is prepared.

[0035] 20 micrometers of said minimum value have little telescopic motion according [ the case of the thickness not more than this ] to a temperature change, and is because it is not necessary to establish a curvature control means. Moreover, the maximum of 150 micrometers is determined from relation with the minimum clearance distance in which it approves between the distance of the objective lens of the optical head at the time of informational record/playback, and said recording layer 20, and this objective lens and optical recording medium 10.

[0036] Furthermore, in the example of the gestalt of the above-mentioned implementation, although the curvature control layer 28 is formed in the field of the light transmission layer 24 and the opposite side of the support base 12 by uniform thickness As it is not limited to this and shown in drawing 3 , this invention is the pattern which serves as an equiangular distance for a long time at a circumferencial direction, and may form the 2nd curvature control layer 34 in the radiation direction with the same ingredient as said curvature control layer 28.

[0037] In addition, as an ingredient of said support base 12, this invention is applied, also when using polyolefine etc. in addition to the above polycarbonates.

[0038] Moreover, especially the approach of formation of a curvature control layer is not limited, either, but an approach can apply variously a spin coat method, the roll coat method, screen printing, etc., and there is effectiveness of curvature control also in the printing layer performed using screen printing.

[0039] Furthermore, said recording layer is not limited to the example of the gestalt of operation, but should just have a light transmission layer on a recording layer as an account record medium of light again that what is necessary is just record and/or the single constituted refreshable, or two or more layers.

[0040] Therefore, the sequence of the existence of the reflective film and a dielectric layer or these and a recording layer, a light transmission layer, and the laminating of a support base etc. is not limited to the example of the gestalt of operation.

[0041]

[Example] When were shown in said drawing 1 and it was shown in said drawing 2 in 21-25 degrees C and the environment of 45 - 55% of relative humidity after aging [ examples / of a comparison / other / of 12 hours ] the same optical recording medium at 80 degrees C, the variation of the amount of curvatures was measured by the same measuring method, and the axis of ordinate was set as the variation, the axis of abscissa was set as the time amount from measurement initiation, and it expressed to drawing 4 .

[0042] The sign A of drawing 4 is the measured value of the example of a comparison which prepared the layer in which the example of a comparison and B which removed the curvature control layer from the optical recording medium of drawing 1 have the same example as the optical recording medium of drawing 1 between the curvature control layer of the optical recording medium of drawing 1 , and a support base, and C has the moisture-proof effectiveness.

[0043] As A of drawing 4 also shows, it turns out that contraction of a light transmission layer arises by heat dissipation within 10 minutes after measurement initiation, and it generates steeply [ curvature ] and greatly by this. Moreover, when it is B in which the light transmission layer is prepared as a curvature control layer, it turns out that there is little variation of the amount of curvatures by the temperature change as compared with A. Furthermore, if the layer which has the moisture-proof effectiveness like C is prepared, it turns out that change of the amount of curvatures by moisture absorption can also be made small.

[0044] When were shown in drawing 1 , and the curvature control layer of the same ingredient as this is prepared in the opposite side of a light transmission layer and the thickness is changed into drawing 5 and 6

in the same optical recording medium, and when shown in drawing 4 at the time of replacing with a curvature control layer and preparing a printing layer, the result of having measured the variation of the amount of curvatures on the same conditions is shown.

[0045] These drawings show that the variation of the amount of curvatures of an optical recording medium is manageable within 0.4 degrees by preparing adjustment and the printing layer of the thickness of a curvature control layer.

[0046]

[Effect of the Invention] This invention has the outstanding effectiveness that the variation of the amount of curvatures generated by collapse of stress balance based on telescopic motion of the light transmission layer by this temperature change can be controlled in constant value, even if a steep temperature change occurs with a support base in the optical recording medium with which the comparatively thick light transmission layer is prepared, since the design concept of an optical recording medium was constituted as mentioned above.

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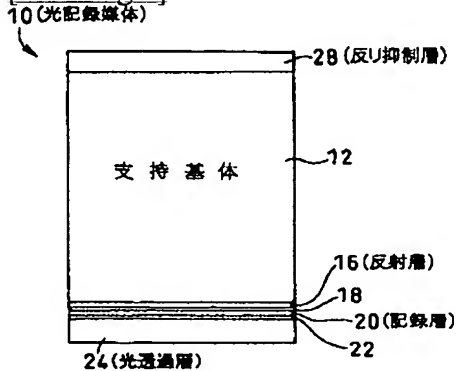
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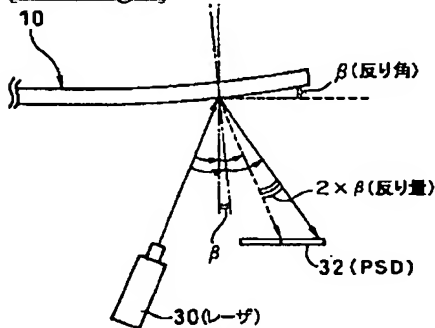
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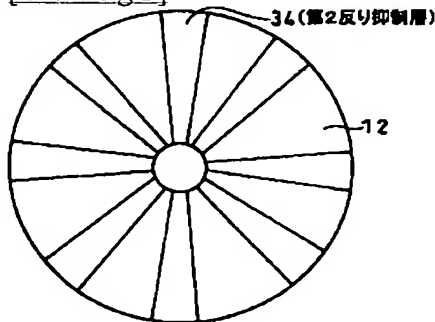
[Drawing 1]



[Drawing 2]

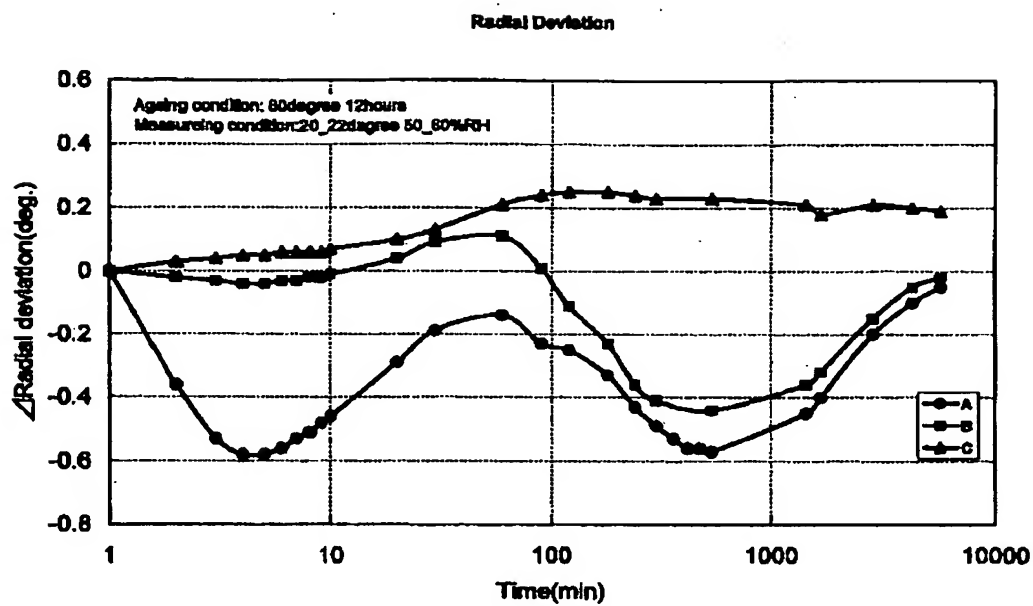


[Drawing 3]

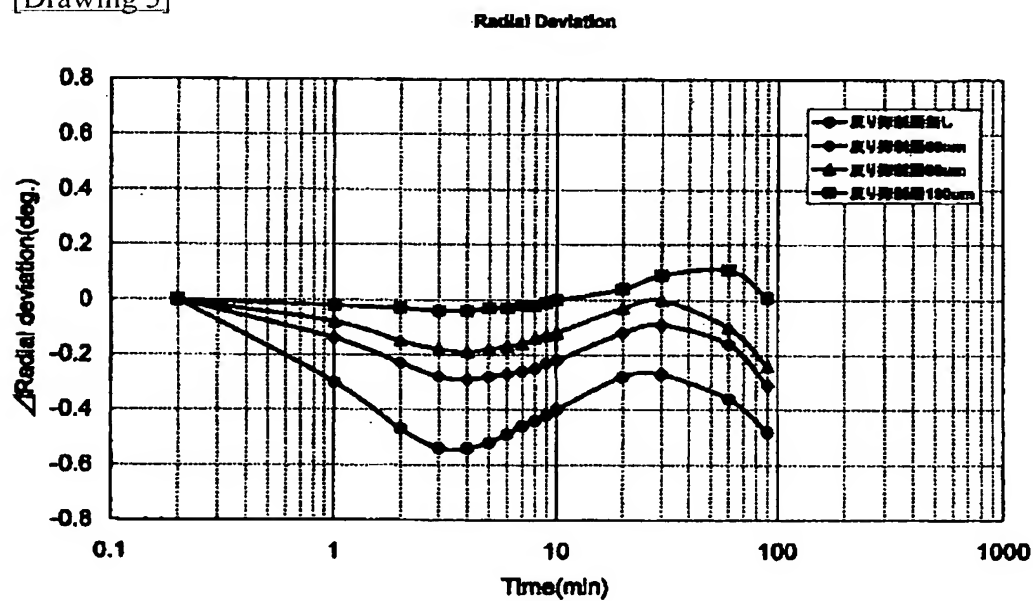


[Drawing 4]

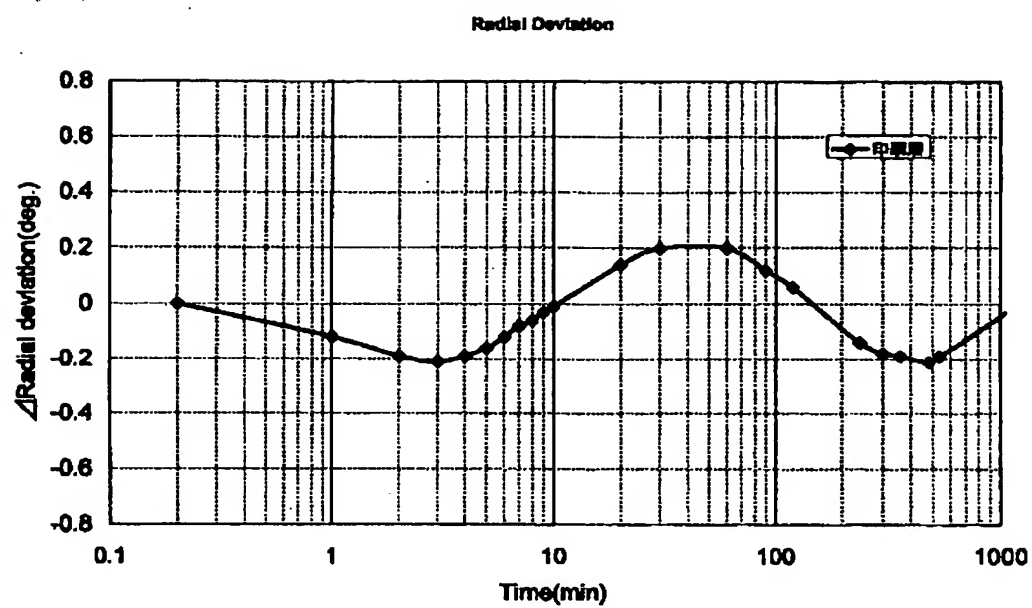




[Drawing 5]



[Drawing 6]



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